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(Research) Article

The Relationship Between Exclusive Breastfeeding and The Incidence of Pneumonia Among Toddlers At Padasuka Health Center, Bandung City, in 2024

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Abstract: Pneumonia is one of the leading causes of death among toddlers in Indonesia. One effective preventive measure is providing exclusive breastfeeding during the first six months of life. This study aims to determine the relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers at the Padasuka Health Center, Bandung City, in 2024. This research employed an analytical quantitative method with a cross-sectional approach and a total sampling technique involving 200 toddlers recorded as having pneumonia based on medical records and IMCI register books. The results showed that 68.5% of toddlers received exclusive breastfeeding, 76.5% experienced mild pneumonia, and 23.5% had severe pneumonia. The Chi-Square test yielded a p-value of 0.001, indicating a significant relationship between exclusive breastfeeding and the severity of pneumonia. Toddlers who did not receive exclusive breastfeeding had a higher risk of developing severe pneumonia compared to those who were exclusively breastfed. In conclusion, exclusive breastfeeding plays an important role in reducing the risk of severe pneumonia among toddlers. It is expected that these findings can serve as a basis for healthcare workers to enhance education for mothers on the importance of exclusive breastfeeding.

Keywords: Bandung City, exclusive breastfeeding, IMCI, pneumonia, todler

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1. INTRODUCTION

Background

Every child born into the world has the right to grow and develop optimally, including the right to receive proper nutrition from an early age. Infancy, particularly the age of 0–6 months, is a very critical period that determines a child's future health quality. During this stage, exclusive breastfeeding (EBF) serves as the only ideal source of nutrition—not only because of its perfect nutritional content but also due to its protective role against various infectious diseases, including pneumonia.

Pneumonia is an acute infection of the lung tissue and remains one of the leading causes of morbidity and mortality among children under five worldwide, especially in developing countries. According to WHO (2023), pneumonia accounts for approximately 15% of all

under-five deaths. Based on the Indonesia Health Profile 2020, pneumonia and diarrhea are the two primary causes of death among children aged 29 days–11 months, with pneumonia contributing to 73.9% of all deaths caused by infectious diseases. At the provincial level, West Java recorded 102,576 cases of pneumonia among toddlers in 2023 (DINKES West Java Province, 2023). This situation is exacerbated by factors such as malnutrition, incomplete immunization, exposure to cigarette smoke or air pollution, and the lack of exclusive breastfeeding.

Breast milk contains various immunological components such as immunoglobulin A (IgA), lactoferrin, lysozyme, and white blood cells, which serve as the baby's natural defense system. These elements are not found in formula milk or other foods besides breast milk. Moreover, breast milk helps develop a healthy gut microbiota, indirectly strengthening the baby's immune system. Therefore, infants who receive exclusive breastfeeding during their first six months of life have better immunity against various infections, including respiratory infections such as pneumonia (Hidayati et al., 2020).

From a non-biological perspective, exclusive breastfeeding also strengthens the emotional bond between mother and child, playing an important role in the child's psychological and social development. Breast milk is not merely food—it is a symbol of love and a fulfillment of a child's basic right to a healthy life. Unfortunately, in practice, many mothers do not provide exclusive breastfeeding due to limited knowledge, cultural factors, employment demands, or lack of support from their environment. Numerous studies have shown that infants who are not exclusively breastfed have a higher risk of developing pneumonia. The absence of natural antibodies from breast milk makes babies more vulnerable to infections, particularly those affecting their immature respiratory systems (Hidayati et al., 2020).

From the perspective of child development theory and Bronfenbrenner's ecological theory, a child's immediate environment—including maternal caregiving patterns—greatly influences growth, development, and health status. Exclusive breastfeeding is part of a positive interaction within the child's microsystem that determines their quality of life. In addition to exclusive breastfeeding, other contributing factors include nutritional status and immunization status. Nutritional status refers to the condition of the body resulting from the interaction between energy, protein, and other essential nutrient intake with health conditions, while immunization is an effort to actively develop or enhance a person's immunity against specific diseases (Hidayati et al., 2020).

The relationship between exclusive breastfeeding and pneumonia incidence has been widely studied. Research by Abate et al. (2025) reported that infants who did not receive exclusive breastfeeding were 2.34 times more likely to develop pneumonia. Similarly, Karmany et al. (2021) in Indonesia found a significant relationship between lack of exclusive breastfeeding and pneumonia incidence among children under five. However, other studies,

such as Ningsih et al. (2020), revealed that although descriptively more children without exclusive breastfeeding suffered from pneumonia, the relationship was not statistically significant—indicating that other factors, such as living environment, exposure to cigarette smoke, and immunization status, also play a major role.

From a humanitarian standpoint, providing exclusive breastfeeding is not only a biological duty of a mother but also a social and moral responsibility to protect future generations from preventable diseases such as pneumonia (Hidayati et al., 2020).

Based on local data, within the working area of Padasuka Health Center, 29.65% of pneumonia cases among toddlers were recorded within the first three months of 2025, with several toddlers not receiving exclusive breastfeeding—indicating a possible relationship between these two factors.

Considering the description above, the researcher is interested in conducting a study entitled: "The Relationship Between Exclusive Breastfeeding and the Incidence of Pneumonia Among Toddlers at Padasuka Health Center, Bandung City, in 2024."

Problem Formulation

Berdasarkan Based on the background described above, the problem in this study can be formulated as follows: "Is there a relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers at Padasuka Health Center, Bandung City, in 2024?"

Research Objectives

General Objective

To determine the relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers as a basis for promotive and preventive interventions in maternal and child health services.

Specific Objectives

1. To identify the description of exclusive breastfeeding practices among toddlers at Padasuka Health Center.
2. To identify the incidence rate of pneumonia among toddlers at Padasuka Health Center.
3. To analyze the relationship between exclusive breastfeeding status and the incidence of pneumonia among toddlers.

Research Benefits

Theoretical Benefits

This study is expected to contribute to the development of scientific knowledge, particularly in the field of midwifery and child health, regarding the importance of exclusive breastfeeding in preventing respiratory tract infections such as pneumonia. The results of this study may also serve as an additional reference for future research related to breastfeeding and child health.

Manfaat Praktis

1. For Healthcare Workers: To enhance understanding and awareness among healthcare professionals, especially midwives, regarding the importance of promoting and educating about exclusive breastfeeding as an effort to prevent pneumonia in toddlers.
2. For the Community: To provide information and understanding to mothers about the benefits of exclusive breastfeeding in maintaining their child's health and immunity, thereby reducing the risk of pneumonia.
3. For Educational Institutions: To serve as study material or scientific reference in midwifery education institutions to improve the quality of learning about the role of breastfeeding in child health.
4. For Future Researchers: To serve as a foundation or reference for further research exploring the relationship between breastfeeding patterns and the incidence of other diseases in children.

Scope of Research

Location Scope

This research will be conducted at the Padasuka Health Center.

Time Scope

The research period will take place from February to June 2025, including data collection, analysis, and preparation of the research report.

2. LITERATURE REVIEW

Breast Milk (*ASI*)

Definition of Breast Milk

Breast milk (*ASI*) is an emulsion of fat in a solution of protein, lactose, and minerals. During the first six months after childbirth, the average amount of breast milk produced by a mother is about 780 ml/day, decreasing to 600 ml/day in the following six months. Maternal nutrition can affect the composition of breast milk. The nutritional aspects that influence breast milk composition include maternal dietary intake, nutrient reserves, and the mother's ability to absorb nutrients.

The composition of breast milk changes over time and is influenced by several factors, including the stage of lactation, the mother's nutritional status, and her dietary intake. According to the stage of lactation, breast milk is divided into colostrum, transitional milk, and mature milk. The composition is affected by both the mother's nutritional status and dietary intake because the energy and nutrients in breast milk come from two main sources: the mother's body fat reserves and her dietary intake (Andini Octaviana et al., 2020:17).

1. **Colostrum**

   Colostrum is a thick, yellowish milk produced from the first day until around the seventh to tenth day after childbirth. Its yellow color comes from beta-carotene. The

nutrient composition of colostrum changes from day to day. When heated, colostrum coagulates. It has a more alkaline pH compared to mature milk, and its volume ranges from 2–20 ml during the first three days after birth (Andini Octaviana et al., 2020:18).

2. **Transitional Milk**

Transitional milk is the phase between colostrum and mature milk, produced from about the seventh or tenth day up to the second week postpartum. The vitamin content is lower than in colostrum, while the protein level decreases and carbohydrate and fat levels increase. The volume of milk also rises during this stage (Andini Octaviana et al., 2020:19).

3. **Mature Milk**

Mature milk is the predominant form of breast milk secreted from the second week after childbirth onward. It provides approximately 75 kcal per 100 ml. Its composition is relatively constant (some sources note stability starting from the third to fifth week). Mature milk is a water-based solution with a slightly yellowish-white color due to Ca-caseinate salts, riboflavin, and carotene. Unlike colostrum, it does not coagulate when heated.

Mature milk contains antimicrobial factors such as antibodies, bacteria, viruses, and enzymes (lysozyme, lactoperoxidase, lipase, catalase, phosphatase, amylase, phosphodiesterase, and alkaline phosphatase), proteins, staphylococcal resistance factors, complements, and interferon-producing cells. It has unique biochemical properties, including low buffering capacity, the presence of the bifidus factor, and various hormones. Lactobacillus bifidus ferments lactose into lactic acid, lowering the pH and thereby inhibiting the growth of pathogenic bacteria. The leukocyte content and pH of breast milk help prevent the growth of harmful bacteria (Andini Octaviana et al., 2020:20).

Components of Breast Milk

The research was conducted at the Padasuka Health Center facility.

Water in Breast Milk

Water is the major component of breast milk, accounting for about 88% of its total volume. It dissolves nutrients and helps regulate body temperature. Infants lose about 25% of their body heat through water excretion via the kidneys and skin, making breast milk a safe and reliable source of hydration. The high water content in breast milk helps relieve the baby's thirst (Andini Octaviana et al., 2020:20).

Carbohydrates in Breast Milk

About 90% of the energy in breast milk comes from carbohydrates and fats, while only 10% comes from protein. The main carbohydrate in breast milk is lactose, which is present at around 7 grams per 100 ml. This high lactose content promotes the growth of beneficial microorganisms that produce lactic acid, creating an acidic environment in the infant's intestines that offers several advantages:

1. Inhibits the growth of pathogenic bacteria.
2. Stimulates the growth of microorganisms that produce organic acids and synthesize vitamins.
3. Facilitates the precipitation of calcium caseinate and improves the absorption of minerals such as calcium, phosphorus, and magnesium.

Although lactose is relatively insoluble and digested slowly, it is well absorbed by the infant's intestines. In addition to lactose, breast milk contains glucose (1.4 g/100 ml), galactose (1.2 g/100 ml), and glucosamine (0.7 g/100 ml). Galactose plays an important role in brain and spinal cord development, myelin formation, and galactoside synthesis. Glucosamine acts as a bifidus factor, stimulating the growth of Lactobacillus bifidus, a beneficial bacterium (Andini Octaviana et al., 2020:20).

Protein in Breast Milk

The protein concentration in breast milk decreases from colostrum to mature milk: colostrum (2%), transitional milk (1.5%), and mature milk (1%). Proteins in breast milk include casein, serum albumin, α-lactalbumin, β-lactoglobulin, immunoglobulins, and other glycoproteins (Andini Octaviana et al., 2020:20).

Fat in Breast Milk

The fat content in breast milk varies throughout the day (morning, afternoon, and night). On average, every 100 ml of breast milk contains 3.5–4.5 g of fat. Fat serves as the main source of calories for infants and aids in the digestion of fat-soluble vitamins (A, D, E, and K) as well as in providing essential fatty acids. About 90% of breast milk fat is in the form of triglycerides, but it also contains EPA and DHA, which are crucial for brain development. Breast milk also contains the enzyme lipase, which assists in fat digestion. If the mother's dietary intake is insufficient, the required nutrients are drawn from her body's fat stores (Andini Octaviana et al., 2020:20).

The Benefits of Breast Milk for Infants and Mothers

The research period was from February to June 2025, including data collection, analysis, and the preparation of the research report.

Benefits of Breast Milk for Infants

1. **Breast Milk as an Ideal Source of Nutrition**

   The composition of breast milk is perfectly suited to meet the nutritional needs of infants according to their age. After the age of six months, babies should begin to receive solid foods, but breastfeeding can be continued up to two years or longer (Andini Octaviana et al., 2020:22).

2. **Breast Milk Enhances the Infant's Immune System**

   Infants who receive colostrum naturally obtain immunoglobulin A (IgA), an antibody that is not found in cow's milk. A baby's body can only produce a sufficient amount of protective immune cells between 9 to 12 months of age. Breast milk is a

living fluid containing protective factors that safeguard infants against infections caused by bacteria, viruses, parasites, and fungi. Colostrum contains 10–17 times more immune substances than mature milk. Breastfeeding protects infants from allergies and infectious diseases such as diarrhea, ear infections, coughs, and colds. Several studies have shown that exclusively breastfed infants are healthier and experience fewer illnesses than those who are not exclusively breastfed (Andini Octaviana et al., 2020:22).

3. **Contains Digestive Enzymes and Balanced Nutrients**

Breast milk not only provides the right amount of nutrients but also contains a perfect balance of proteins and fatty acids, making it easy for infants to digest. It also contains gut flora such as bifidobacteria, which play an important role in human digestion. One of their functions is to facilitate digestion so that nutrient absorption becomes easier and faster (Andini Octaviana et al., 2020:22).

4. **Contains Disease-Fighting Substances**

At birth, babies receive antibodies from their mothers, but these decrease soon after birth. Studies show that breastfeeding protects infants from various infectious diseases, such as respiratory and digestive tract infections and diarrhea. A meta-analysis by Allen and Hector (2005) revealed that in both developed and developing countries, breastfed infants have a lower risk of infectious diseases. This protective effect is due to the immunoglobulins (IgA, IgM, IgD, IgE) and antibacterial substances contained in breast milk. Infants who receive colostrum obtain IgA and leukocytes that inhibit the growth of pathogenic bacteria, whereas non-breastfed infants are less able to suppress these bacteria, since their bodies begin producing IgA only a few months later (Andini Octaviana et al., 2020:22).

Benefits of Breast Milk for Mothers

1. **Accelerates Uterine Involution**

Uterine involution is the process by which the uterus returns to its pre-pregnancy state. Breastfeeding immediately after birth or initiating early breastfeeding stimulates the release of oxytocin. This hormone not only contracts the smooth muscles of the breast but also triggers uterine contractions, helping the uterus return to its normal size (Andini Octaviana et al., 2020:22).

2. **Helps Restore Pre-Pregnancy Weight**

Many mothers strive to regain their pre-pregnancy weight. Breastfeeding is an effective way to burn calories — approximately 700 kcal are needed daily for milk production, 200 kcal of which come from the mother's fat reserves. Longitudinal studies show that the highest weight loss occurs during the first 4–6 months of breastfeeding, depending on duration and diet. Research consistently concludes that breastfeeding mothers, especially those who breastfeed exclusively, experience greater

postpartum weight loss compared to non-breastfeeding mothers (Andini Octaviana et al., 2020:22).

3. **Serves as a Natural Method of Family Planning (Contraception)**

   Breastfeeding can influence maternal hormones, suppressing ovulation. Breastfeeding can serve as an effective natural contraceptive method under the following conditions:

   a) The baby is less than six months old.
   b) The baby is exclusively breastfed at least ten times a day.
   c) The mother has not yet resumed menstruation (Andini Octaviana et al., 2020:22).

Exclusive Breastfeeding

Exclusive breastfeeding refers to feeding infants only breast milk — without any additional food or drink (except medicines in syrup form) — during the first six months of life. At this stage, babies do not need any food other than breast milk (Ministry of Health of the Republic of Indonesia, 2024).

Exclusive breastfeeding provides the best nutrition for infants, containing all the essential nutrients required for healthy growth and development. If infants are given water or other liquids, they may feel full quickly and refuse to breastfeed. During this period, babies experience rapid physical and mental development. Providing only breast milk until the age of six months supports optimal growth and offers the following benefits:

1. **Promotes Health and Intelligence**

   Breast milk is rich in fatty acids that support optimal physical and brain development, helping the baby grow smarter.

2. **Boosts the Immune System**

   Breast milk contains antibodies from the mother, which strengthen the baby's immune system and protect against diseases such as diarrhea, respiratory infections, ear infections, and meningitis. A strong immune system also helps reduce the risk of allergies, which occur when the immune system reacts excessively to certain substances.

3. **Maintains an Ideal Body Weight**

   Breast milk regulates the hormone leptin, which controls appetite and fat metabolism, helping infants maintain a healthy weight and preventing stunting (Ministry of Health of the Republic of Indonesia, 2024).

Pneumonia in Toddlers

Definition of Pneumonia

Pneumonia is an acute inflammation of the lung parenchyma caused by infection with pathogens (bacteria, viruses, fungi, or parasites), excluding *Mycobacterium tuberculosis*. Inflammation of the lungs caused by non-infectious factors (such as chemicals, radiation,

aspiration of toxic substances, medications, and others) is referred to as pneumonitis. Community-acquired pneumonia is defined as an acute inflammation of the lung parenchyma caused by infection with pathogens acquired outside the hospital or in the community (PDPI, 2022).

Pneumonia can be caused by various microorganisms, including bacteria, viruses, fungi, and protozoa, with most cases caused by bacteria. The most common cause of bacterial pneumonia is *Streptococcus pneumoniae* (a gram-positive bacterium), which causes streptococcal pneumonia. Other bacterial causes include *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Pneumonia may also be caused by viruses, such as the influenza virus. The symptoms of infectious pneumonia result from the invasion of the lungs by microorganisms and the immune system's response to infection. Although more than a hundred types of microorganisms can cause pneumonia, only a few are responsible for most cases. The most common causes are bacteria and viruses, while fungi and parasites are less common causes of infectious pneumonia (Nursing Journal, 2022).

Factors Causing Pneumonia in Toddlers

1. **Nutritional Status**

   Nutritional status refers to the condition of the body as a result of the interaction between the intake of energy, protein, and other essential nutrients with the overall health condition. It represents the balance between nutrient intake and the body's needs, expressed through certain variables. An imbalance (either excess or deficiency) between nutrient intake and bodily needs can lead to pathological disorders in humans (Hidayati et al., 2020).

   Such a condition is referred to as malnutrition (nutritional disorder). In general, nutritional disorders are categorized into two types: Overnutrition, which occurs when the body consumes certain nutrients in amounts exceeding its needs for a prolonged period; undernutrition, which occurs when daily nutrient intake is insufficient to meet the body's needs (Hidayati et al., 2020).

   Toddlers with poor nutritional status are more susceptible to pneumonia than those with adequate nutrition due to a weakened immune system. Infectious diseases can also reduce appetite, further worsening nutritional deficiencies. In such cases, undernourished children are more likely to contract pneumonia, and the infection tends to last longer (Nursing Journal, 2022).

2. **Immunization Status**

   Immunization is an effort to induce or increase a person's active immunity against a particular disease so that when exposed to the disease, the person will not become ill or will only experience mild symptoms. The purpose of immunization is to reduce morbidity, mortality, and disability caused by vaccine-preventable diseases (Nursing Journal, 2022).

3. **Exclusive Breastfeeding**

   Exclusive breastfeeding refers to feeding infants only breast milk, without any additional food or drink, from birth until six months of age, except for medicines and vitamins (WHO, 2020). Exclusive breastfeeding is the best source of nutrition for infants up to six months old. Breast milk contains vitamins, minerals, fats, carbohydrates, and proteins that play a crucial role in protecting children from infections such as pneumonia.

Breast milk can prevent pneumonia by making bacteria more sensitive and killing them—a process known as synthetic lethality, which helps weaken bacterial resistance to antibiotics. Breast milk contains two proteins that act as natural antibiotics: lactoferrin, which fights viral, fungal, and bacterial infections, and HAMLET (a protein found in human milk). One of the risk factors for pneumonia is not receiving exclusive breastfeeding. Studies show that exclusive breastfeeding strengthens infants and helps protect them from various diseases, including pneumonia (Nursing Journal, 2022).

Signs and Symptoms of Pneumonia

According to the Bandung District Health Office (2023), toddlers may experience the following symptoms:

1. Cough and runny nose
2. Fever
3. Sore throat
4. Wheezing or noisy breathing
5. Nausea or vomiting
6. Diarrhea
7. Decreased appetite
8. Increased irritability or frequent crying
9. Fatigue and difficulty concentrating

Prevention of Pneumonia

1. **Provide Exclusive Breastfeeding, Adequate Complementary Feeding (MPASI), and Nutritious Foods**

   Exclusive breastfeeding during the first six months of life is an effective way to protect children from pneumonia and other infectious diseases. Breast milk strengthens the infant's immune system.

2. **Avoid Polluted Environments (Smoke from Vehicles, Factories, or Cigarettes)**

   A healthy immune system helps protect the body from infection. However, many factors can weaken it—air pollution is one of them, especially in children. Both outdoor and indoor air pollution pose risks. Indoor air pollution—caused by cooking fuels, cigarette smoke, and other pollutants—contributes to approximately 62% of child deaths from pneumonia related to air pollution.

3. **Handwashing with Soap**

Pneumonia can also be prevented by promoting protective health practices, such as handwashing with soap. Studies have shown that handwashing with soap reduces the risk of pneumonia by decreasing exposure to bacteria. In Indonesia, 64% of the population had access to basic handwashing facilities in 2017.

4. **Complete Child Immunization**

Almost all pneumonia-related deaths are preventable. The most effective way to protect children from pneumonia is through immunization, particularly against Haemophilus influenzae type b (Hib), pneumococcus, measles, and pertussis (Yogyakarta City Health Office, 2022).

Classification of Pneumonia

According to the World Health Organization (WHO, 2020), the classification and treatment of pneumonia in children based on the latest scientific evidence are as follows:

1. **Pneumonia**

Characterized by rapid breathing and/or chest indrawing. It can be treated at home with amoxicillin.

2. **Severe Pneumonia**

Characterized by the presence of general danger signs such as:

a) Inability to drink or breastfeed
b) Persistent vomiting
c) Convulsions
d) Lethargy or unconsciousness
e) Stridor when calm
f) Severe malnutrition

The Relationship Between Exclusive Breastfeeding and the Incidence of Pneumonia

Mechanism of Breast Milk Protection Against Pneumonia

Exclusive breastfeeding means that the infant receives only breast milk, without any additional food or drink, for the first six months of life. International guidelines recommending exclusive breastfeeding for the first six months are based on scientific evidence demonstrating its benefits for infant survival, growth, and development. The immune system of infants under six months is not yet fully developed (Marni, 2021). Theoretically, breast milk contains **colostrum**, which is rich in antibodies and immune proteins that help the body fight bacteria. Therefore, exclusive breastfeeding can significantly reduce the risk of infant mortality caused by infectious diseases such as diarrhea and respiratory infections, including acute respiratory infections (ARI) and pneumonia (Wijayanti, 2020).

Studies Related to Breastfeeding and Pneumonia Incidence

Several studies have shown that breastfeeding, particularly exclusive breastfeeding, is significantly associated with a decreased incidence of respiratory infections, including pneumonia, among toddlers. Breast milk contains various immunological substances such as immunoglobulin A (IgA), lactoferrin, lysozyme, and immune cells (macrophages and lymphocytes) that help strengthen the infant's immune defense system, especially in the respiratory tract.

A meta-analysis by Karmany et al. (2021) found that children under five who did not receive exclusive breastfeeding had a significantly higher risk of developing pneumonia. The study concluded that exclusive breastfeeding during the first six months of life substantially reduces the risk of pneumonia.

Another study by Kang et al. (2024) in the Journal of Community Health Nursing showed that the duration of exclusive breastfeeding influences the incidence of pneumonia among infants aged 0–6 months. Infants who received exclusive breastfeeding had a lower incidence of pneumonia and shorter hospital stays compared to those who were not exclusively breastfed.

A study by Abate et al. (2025) published in the International Breastfeeding Journal also supported these findings. Through a systematic review involving more than 10 million children from various countries, the researchers found that not receiving exclusive breastfeeding increased the risk of pneumonia by 2.34 times compared to children who were exclusively breastfed.

In Indonesia, a local study by Sari and Widyastuti (2021) conducted at a Community Health Center (Puskesmas) in Central Java found that children who did not receive exclusive breastfeeding were at a higher risk of developing pneumonia. The study concluded that exclusive breastfeeding is a key determinant in preventing respiratory infections among toddlers.

These findings reinforce the understanding that exclusive breastfeeding has a protective effect against the incidence of pneumonia in young children.

3. RESEARCH METHODS

Research Design

This study uses a quantitative analytic design with a cross-sectional approach, a method in which data on exclusive breastfeeding (Yes/No) and pneumonia status (Pneumonia/Severe Pneumonia) are measured simultaneously without long-term observation. The aim of this study is to analyze the effect of exclusive breastfeeding on the incidence of pneumonia among toddlers in 2024 at Padasuka Community Health Center (Puskesmas Padasuka).

Conceptual Framework

Pneumonia is one of the leading causes of death among children under five worldwide, especially in developing countries such as Indonesia. According to data from the World Health Organization (WHO, 2023), pneumonia accounts for approximately 14% of global under-five deaths, causing more than 740,000 child deaths annually. In Indonesia, pneumonia remains a major public health concern and is among the top ten causes of child mortality (Ministry of Health of the Republic of Indonesia, 2022).

One of the key strategies to prevent pneumonia in toddlers is exclusive breastfeeding. The WHO and UNICEF recommend exclusive breastfeeding for the first six months of life because breast milk contains natural antibodies and essential nutrients that play a vital role in building a strong immune system in infants (WHO, 2023).

Physiologically, breast milk contains immunoglobulin A (IgA), lactoferrin, lysozyme, and various immune cells (such as macrophages and lymphocytes) that help protect the infant's respiratory tract from bacterial and viral infections. In other words, infants who are exclusively breastfed have stronger immune systems and are more capable of resisting respiratory infections, including pneumonia (Victora et al., 2016).

Conversely, infants who do not receive exclusive breastfeeding are more susceptible to infections because their immune systems are not yet fully developed and they lack the immunological protection provided by breast milk. Several studies have shown that toddlers who are not exclusively breastfed have a 2–4 times higher risk of developing pneumonia compared to those who are exclusively breastfed (Lamberti et al., 2021).

In addition, environmental factors, socioeconomic conditions, and maternal childcare practices also contribute to the incidence of pneumonia. However, exclusive breastfeeding remains one of the most effective, affordable, and accessible protective measures, particularly in communities with limited access to healthcare services.

Based on this rationale, there is a logical relationship between exclusive breastfeeding and a reduced risk of pneumonia among toddlers. Therefore, it is essential to conduct further research to determine whether there is a significant association between exclusive breastfeeding and the incidence of pneumonia among toddlers in specific regions.

Diagram 1 Conceptual Framework .

Variables

A variable is the object of research or the focus of a researcher's attention. In this study, there are two types of variables: the independent variable and the dependent variable.

Independent Variable

The independent variable in this study is Exclusive Breastfeeding.

Dependent Variable

The dependent variable in this study is the Incidence of Pneumonia among Toddlers at Padasuka Community Health Center.

Operational Definition

An operational definition refers to defining a variable based on observable characteristics, allowing researchers to conduct precise observations or measurements of an object or phenomenon (Ulfa Rafika, 2021: 350). The operational definitions used in this study are as follows:

Table 1 Operational Definition.

Variable	Operational Definition	Measure-ment Tool	Scale	Category
Exclusive Breastfeeding	Providing only breast milk for six months without any additional food or drink, except for medicines in syrup form (Ministry of Health of the Republic of Indonesia, 2024).	Medical records and IMCI register/master table	Nominal	0 = Exclusive Breastfeeding 1 = Non-exclusive Breastfeeding
Incidence of Pneumonia	The occurrence of an acute infection in the lung tissue (alveoli) affecting toddlers (Nurmalita Rachma et al., 2024).	Medical records/master table	Nominal	0 = Pneumonia: rapid breathing 1 = Severe Pneumonia: chest indrawing or oxygen saturation < 90%

Population and Sample

Population and

The population in this study includes all toddlers diagnosed with pneumonia in 2024, totaling 235 children, based on medical records, child health registers, and records of those who underwent Integrated Management of Childhood Illness (IMCI) examinations at Padasuka Community Health Center.

Sample

The sampling technique used in this study is total sampling. The population in this study consists of toddlers who underwent IMCI examinations and have complete data according to the inclusion and exclusion criteria described below:

1. Inclusion Criteria: Toddlers with a medical diagnosis of pneumonia.
2. Exclusion Criteria: Incomplete data, such as missing information regarding the history of exclusive breastfeeding in medical records.

Data Collection and Management

Data Collection Technique

This study uses secondary data collection methods, meaning that data are obtained from existing sources without conducting interviews or direct observations. The primary technique used is documentary study, which involves accessing and analyzing medical records and IMCI registers of toddlers at Padasuka Community Health Center. The data collected include information about exclusive breastfeeding practices among toddlers, as well as other supporting data available in medical records.

Data Management Technique

Data processing is an essential stage in research, as it ensures that the collected data can be analyzed systematically. According to Notoatmodjo (2018), several steps are involved in the data management process:

1. **Editing**

   Reviewing the completeness and accuracy of data obtained from medical records and IMCI registers to ensure that no data are missing, incomplete, or invalid—particularly data related to exclusive breastfeeding and pneumonia incidence among toddlers.

2. **Coding**

   Assigning numerical codes to data to facilitate analysis, as follows:

   Exclusive Breastfeeding

   a) Exclusive Breastfeeding → Code 0
   b) Non-exclusive Breastfeeding → Code 1

   Pneumonia Incidence among Toddlers

   a) Pneumonia → Code 0
   b) Severe Pneumonia → Code 1

3. **Data Entry**

   Entering the coded data into a statistical program such as SPSS or Microsoft Excel to facilitate data processing and analysis.

4. **Data Processing**

   a) Tabulation

   Data are organized into tables based on the following categories:

1) Exclusive Breastfeeding (Exclusive, Non-exclusive)
2) Pneumonia Incidence (Pneumonia, Severe Pneumonia)

b) Descriptive Statistical Analysis

Calculating averages, standard deviations, and percentage distributions.

c) Relationship Analysis

1) Frequency distribution is used to identify patterns of association between exclusive breastfeeding and pneumonia incidence among toddlers.
2) Statistical tests are conducted to determine whether there is a significant relationship between the two variables.

Data Analysis

The univariate analysis is used to describe the characteristics of each research variable, namely exclusive breastfeeding and the incidence of pneumonia among toddlers. The data are presented in the form of frequency distributions, percentages, means, and standard deviations to provide a general overview of each variable.

Univariate Analysis

The purpose of univariate analysis is to describe the characteristics of each variable, such as calculating the percentage of toddlers who received exclusive breastfeeding and the number of pneumonia cases. The results are presented in frequency distribution tables and diagrams. The formulas used for frequency and percentage are as follows:dan Persentase

f = f/n x 100%

Where:

P = Percentage for each category

F = Frequency (number of respondents' answers)

N = Total number of observations

Bivariate Analysis

Bivariate analysis is conducted to examine the relationship between exclusive breastfeeding and the incidence of pneumonia, as well as between vitamin A supplementation and the incidence of pneumonia.

Statistical Test Used

Because the analyzed variables are measured on a nominal scale, the appropriate statistical test is the Chi-Square Test (χ^2) to determine whether there is a significant relationship between the variables.

Formula for the Chi-Square Test:

$\chi^2 = \Sigma [(O - E)^2 / E]$

Where:

O = Observed frequency

E = Expected frequency

B. Syarat Uji Chi-Square

Categorical Data

The variables being tested must be nominal or ordinal.

Independence

Each respondent must belong to only one category; no data duplication is allowed.

Adequate Cell Frequency

1. Idealnya, frekuensi harapan (expected frequency) di setiap sel tabel kontingensi minimal 5. a. Ideally, the expected frequency in each cell of the contingency table should be at least 5.
2. If some cells have expected frequencies less than 5, the Chi-Square test may still be applied as long as no more than 20% of the cells have expected frequencies below 5.
3. If too many cells have expected frequencies below 5, an alternative test such as Fisher's Exact Test may be used.

Sufficient Sample Size

Although there is no fixed number, a minimum of 30 respondents is generally required to ensure test stability.

Hypothesis

Null Hypothesis (H_0)

There is no relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers.

Alternative Hypothesis (Ha)

There is a relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers.

Research Ethics

Research ethics are intended to ensure that the study conducted does not cause harm to the research participants. Ethical considerations are especially important when a study involves human subjects, particularly when any invasive actions or sensitive data collection are involved. Even though this study uses a quantitative approach and secondary data, ethical principles must still be upheld, as the data reflect personal health information. The following ethical principles are applied in this study:

Ethical Clearance

Every research activity involving human subjects must comply with ethical standards. Therefore, researchers using human data must obtain approval from a medical ethics committee. To obtain this approval, the researcher must first receive a formal research permit from the relevant institution. In this study, the researcher submitted the research title for approval to the supervisor at Poltekkes TNI AU Ciumbuleuit Bandung. The research was conducted after receiving approval (title endorsement and proposal authorization) and after obtaining an official research permit from the campus following standard procedures. Every research activity involving human subjects must comply with ethical standards. Therefore,

researchers using human data must obtain approval from a medical ethics committee. To obtain this approval, the researcher must first receive a formal research permit from the relevant institution. In this study, the researcher submitted the research title for approval to the supervisor at Poltekkes TNI AU Ciumbuleuit Bandung. The research was conducted after receiving approval (title endorsement and proposal authorization) and after obtaining an official research permit from the campus following standard procedures.

Informed Consent

Before data collection, the researcher explained the purpose, objectives, and benefits of the study to the medical record officers at Padasuka Community Health Center, particularly that the research aims to determine whether there is a relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers. The results of this study are expected to provide input for the health center management as a basis for future policy-making.

This study does not pose any negative impact since the researcher guarantees to protect the rights of patients by maintaining data confidentiality. The identity of each patient and all provided information are kept confidential and securely stored by the researcher.

Anonymity

The identities of the respondents are not included in the data collection forms or research results. Instead, the researcher uses symbols or numerical codes to represent each sample in the dataset.

Confidentiality

The researcher guarantees the confidentiality of all research data and information obtained. No data will be disclosed or published to unauthorized parties. All data and information are securely stored by the researcher and used solely for academic purposes.

Respect for Person

The researcher shows respect toward all individuals involved in or supporting the research process. Since this study uses secondary data, the researcher expresses gratitude to the staff of UPTD Padasuka Community Health Center, Bandung, by giving a small token of appreciation for their assistance and cooperation during the research process.

Beneficience dan Nomalefience

Ethical issues may arise in any study, as research can potentially benefit or harm participants. However, since this study uses secondary data and does not involve direct contact with human subjects, there is no risk of harm to any individual.

Justice

The researcher ensures fairness and equality toward all subjects by avoiding discrimination based on religion, ethnicity, nationality, or culture. Every respondent who meets the inclusion criteria is treated equally and has the same opportunity to be included as a research sample.

4. RESEARCH RESULTS AND DISCUSSION

Research Results

In this study, the respondents were all toddlers diagnosed with pneumonia at Padasuka Community Health Center, Bandung City, in 2024, totaling 200 respondents. The purpose was to determine the relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers. The results are presented as follows:

Exclusive Breastfeeding among Toddlers at Padasuka Community Health Center, Bandung (2024)

Tabel 1 Frequency Distribution of Exclusive Breastfeeding at Padasuka Health Center (2024).

Exclusive Breastfeeding	F	%
Yes	**137**	**68,5%**
No	**63**	**31,5%**
Total	**200**	**100%**

Based on Table 4.1, out of 200 respondents, 137 toddlers (68.5%) received exclusive breastfeeding. This indicates that a large proportion of mothers already understand the importance of exclusive breastfeeding for their children.

Incidence of Pneumonia among Toddlers at Padasuka Community Health Center, Bandung (2024)

Tabel 2 Frequency Distribution of Pneumonia Incidence among Toddlers at Padasuka Health Center (2024).

Pneumonia Type	F	%
Pneumonia	**153**	**76,5%**
Severe Pneumonia	**47**	**23,5%**
Total	**200**	**100%**

As shown in Table 4.2, out of 200 respondents, 153 toddlers (76.5%) were diagnosed with pneumonia, while 47 toddlers (23.5%) had severe pneumonia. Although the majority of cases were classified as pneumonia, this figure remains a public health concern, as pneumonia contributes significantly to morbidity among toddlers. If not properly managed, mild pneumonia can develop into a more severe and life-threatening form.

Relationship between Exclusive Breastfeeding and the Incidence of Pneumonia among Toddlers at Padasuka Community Health Center, Bandung (2024)

Tabel 3 Relationship between Exclusive Breastfeeding and Pneumonia Incidence among Toddlers at Padasuka Health Center (2024).

Exclusive Breastfeeding	Pneumonia Type				P value
	Pneumonia		Severe Pneumonia		
	f	%	f	%	
Yes	**130**	**94.9%**	**7**	**5,1%**	**0,001**
No	**23**	**36.5%**	**40**	**63,5%**	
Total	**153**	**76,5%**	**47**	**23,5%**	

Based on Table 4.3, among the 200 toddlers studied, 130 children (94.9%) who received exclusive breastfeeding experienced mild pneumonia, while only 7 children (5.1%) developed severe pneumonia. Conversely, among 63 children who did not receive exclusive breastfeeding, only 23 children (36.5%) had mild pneumonia, while 40 children (63.5%) suffered from severe pneumonia. The statistical test yielded a p-value = 0.001, indicating a significant relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers ($p < 0.05$).

Discussion

Based on the results of data analysis regarding the effect of exclusive breastfeeding on the incidence of pneumonia among toddlers at Padasuka Public Health Center, Bandung City, in 2024, the findings indicate a significant relationship between the two variables.

Exclusive Breastfeeding among Toddlers at Padasuka Health Center

As shown in Table 4.1, out of 200 toddler respondents, 137 (68.5%) received exclusive breastfeeding, while 63 (31.5%) did not. This finding indicates that the majority of toddlers within the Padasuka Health Center service area in 2024 were breastfed exclusively, aligning with national health recommendations.

The relatively high rate of exclusive breastfeeding may be attributed to regular health education activities, such as reading sessions from the Maternal and Child Health (KIA) book conducted every morning before maternal and child health services begin. These sessions have helped improve mothers' knowledge and awareness of the benefits of exclusive breastfeeding, leading to greater consistency in its practice.

According to theory, exclusive breastfeeding plays a vital role in enhancing toddlers' immune systems, thereby reducing susceptibility to infectious diseases, including pneumonia. Babies who are not exclusively breastfed tend to have underdeveloped immune systems, making them more prone to respiratory infections such as pneumonia (Sari A.M. et al., 2021).

However, several mothers still fail to practice exclusive breastfeeding, often due to work-related constraints. Working mothers frequently have limited time to breastfeed directly and may opt for formula milk or supplementary food before the infant reaches six months of age. This shows that maternal employment status can be an obstacle to achieving exclusive breastfeeding targets.

This study supports the theoretical framework that exclusive breastfeeding serves as a protective factor against infectious diseases, particularly during infancy. With a high prevalence of exclusive breastfeeding (68.5%), it is expected that morbidity and mortality caused by infectious diseases such as pneumonia can be reduced.

Additionally, breast milk contains important bioactive components such as lactoferrin, immunoglobulin A (IgA), and oligosaccharides, which provide natural defense against bacterial and viral infections. Therefore, it is essential for mothers to understand the long-term benefits of exclusive breastfeeding, not only in terms of nutrition but also for disease prevention and immune development (Sari A.M. et al., 2021).

In conclusion, the results of this study are consistent with both theoretical perspectives and national as well as global health policies that emphasize exclusive breastfeeding as a primary strategy for reducing infectious diseases, including pneumonia, among infants and toddlers.

Incidence of Pneumonia Among Toddlers at Padasuka Public Health Center in 2024

Based on Table 4.2, it is known that out of a total of 200 toddlers who suffered from pneumonia at Padasuka Public Health Center in 2024, 153 (76.5%) experienced pneumonia, while 47 (23.5%) had severe pneumonia.

The occurrence of pneumonia in toddlers is likely influenced not only by exclusive breastfeeding but also by exposure to cigarette smoke within the home environment. This finding is consistent with field observations during practice at Padasuka Public Health Center, where some fathers were still observed smoking near their children. Exposure to cigarette smoke can irritate the respiratory tract and weaken the child's immune system, thereby increasing the risk of developing pneumonia. According to the Ministry of Health of the Republic of Indonesia (2022), children exposed to cigarette smoke have a higher risk of respiratory infections, including pneumonia, compared to those not exposed. This is supported by the study conducted by Kusumaningrum et al. (2021), which showed that indoor cigarette smoke exposure was significantly associated with pneumonia incidence among toddlers.

In terms of child development, toddlers still have an immature immune system, making them more susceptible to respiratory infections such as pneumonia. The relatively high incidence of pneumonia found in this study supports this theory, particularly when associated with other risk factors such as lack of exclusive breastfeeding, vitamin A deficiency, and exposure to cigarette smoke or air pollution in the home environment (Junaidi et al., 2021).

Thus, these findings reinforce the theory that pneumonia is one of the most common infectious diseases among toddlers, especially those with low immunity and poor living environments. Preventive measures such as exclusive breastfeeding, immunization, and maintaining a clean, smoke-free environment are essential to reduce both mild and severe pneumonia cases.

The Relationship Between Exclusive Breastfeeding and the Incidence of Pneumonia Among Toddlers at Padasuka Public Health Center in 2024

Pneumonia is an acute infection that affects lung tissue, particularly the alveoli, which play a vital role in oxygen and carbon dioxide exchange. The manifestation of pneumonia occurs when pathogenic microorganisms such as bacteria (*Streptococcus pneumoniae*, *Haemophilus influenzae*), viruses (e.g., RSV or influenza virus), or fungi (*Pneumocystis jirovecii*) enter and multiply within the lungs. The infection triggers an immune response, leading to inflammation and fluid accumulation in the alveoli, which causes characteristic symptoms such as high fever, productive cough, rapid breathing (tachypnea), shortness of breath, chest retraction, and decreased appetite or activity levels. In severe cases, pneumonia may also cause cyanosis (bluish discoloration of the lips and fingertips) due to oxygen deficiency (WHO, 2023).

Pneumonia occurs most frequently among toddlers, especially children under five years old whose immune systems are still developing. Toddlers who are not exclusively breastfed are at a higher risk because they lose the natural protection provided by antibodies and immune substances in breast milk. Moreover, toddlers with poor nutritional status, incomplete immunization, and those living in crowded, humid environments with exposure to air pollution or cigarette smoke are also more vulnerable to respiratory infections, including pneumonia (IDAI, 2021).

In Bandung City, pneumonia is among the most prevalent diseases affecting toddlers. This is linked to various risk factors commonly found in the region, such as high population density, poor air quality due to traffic congestion and vehicle pollution, and unhealthy housing conditions. Additionally, the low coverage of exclusive breastfeeding and limited public awareness regarding complete basic immunization contribute to the high pneumonia incidence among children. Data from the Bandung City Health Office (2023) in recent years also indicate that pneumonia consistently ranks among the top infectious diseases reported in health facilities among toddlers.

The findings of this study are consistent with previous research showing that exclusive breastfeeding significantly reduces the incidence of pneumonia in toddlers. A study by Agarwal et al. (2021) in India revealed that infants who were not exclusively breastfed had a 2.5 times higher risk of developing pneumonia compared to those exclusively breastfed for the first six months of life. Similarly, research by Sari et al. (2020) in Yogyakarta found that pneumonia was more prevalent among toddlers who did not receive exclusive breastfeeding, with a p value < 0.05, indicating a statistically significant relationship. Furthermore, Rahmah and Lestari (2022) in Bogor Regency found that 72% of toddlers who were not exclusively breastfed experienced lower respiratory tract infections, including pneumonia, compared to only 28% in the exclusively breastfed group, with an odds ratio (OR) of 3.1.

The researcher assumes that the high incidence of pneumonia among toddlers in the Padasuka Public Health Center area is closely related to the low rate of exclusive breastfeeding

during the first six months of life. The lack of maternal awareness about the importance of exclusive breastfeeding in developing a child's immune system from an early age is one of the main causes of toddlers being more susceptible to lower respiratory tract infections, including pneumonia. Breast milk contains natural antibodies such as Immunoglobulin A (IgA), lactoferrin, and other immune components that play crucial roles in protecting infants from bacteria and viruses that cause pneumonia. The absence of exclusive breastfeeding deprives infants of optimal immunological protection, making them more prone to infection.

Environmental factors such as crowded housing, poor ventilation, and cigarette smoke exposure further exacerbate respiratory conditions, particularly in toddlers without the immunological protection provided by breast milk. Additionally, poor nutritional status, incomplete immunization, and the underutilization of health services such as *posyandu* for early infection detection also contribute to the increased risk of pneumonia. Recurrent and untreated upper respiratory infections may also progress to severe pneumonia, especially in children who lack the protective benefits of exclusive breastfeeding.

Therefore, promoting and educating mothers about the importance of exclusive breastfeeding from early infancy is essential to reduce pneumonia rates among toddlers. Exclusive breastfeeding for the first six months of life not only provides optimal nutrition for growth and development but also supplies immune components such as Immunoglobulin A (IgA), lactoferrin, and various immune cells that protect infants from respiratory infections. Exclusive breastfeeding has been proven to reduce pneumonia risk by naturally strengthening the infant's immune system. Hence, the promotion and education of exclusive breastfeeding remain vital strategies to lower pneumonia incidence, particularly in high-prevalence regions such as Bandung City (IDAI, 2021).

Research Limitations

In conducting this study, the researcher acknowledges several limitations that need to be addressed. This study utilized secondary data obtained from medical records at a health care facility. However, during the data collection process, it was found that the recorded information was not always complete or detailed. For instance, information regarding exclusive breastfeeding did not always specify the exact duration or whether it truly lasted for six full months without any additional food or drink.

Moreover, since the data were not originally collected for research purposes, there are concerns about the accuracy and consistency of the records. The researcher could not verify whether the recorded data fully reflected the actual conditions. In some cases, information regarding exclusive breastfeeding was based solely on the mother's verbal statement during her visit to the health center, without further verification, which may have led to reporting bias.

The researcher was also limited to the available data, and not all important variables—such as immunization status, environmental conditions, or nutritional status of the toddlers—

were completely documented, even though these factors could also influence the incidence of pneumonia. This poses a limitation in comprehensively understanding the relationship between exclusive breastfeeding and pneumonia incidence.

Lastly, since this research employed a cross-sectional design, it can only identify associations between exclusive breastfeeding and pneumonia incidence, not establish causation. Therefore, the results of this study are expected to serve as a preliminary foundation for future research using more in-depth and comprehensive methodologies.

5. CONCLUSIONS AND SUGGESTIONS

Conclusions

This study was conducted at the Padasuka Public Health Center in Bandung City to examine the effect of exclusive breastfeeding on the incidence of pneumonia among toddlers in 2024. Based on the findings, the following conclusions can be drawn:

1. The majority of toddlers in the Padasuka Public Health Center area received exclusive breastfeeding, amounting to 68.5% (137 toddlers).
2. The number of pneumonia cases among toddlers reached 200, consisting of 47 (23.5%) cases of severe pneumonia and 153 (76.5%) cases of pneumonia.
3. There is a significant relationship between exclusive breastfeeding and the incidence of pneumonia among toddlers at Padasuka Public Health Center, with a p-value of 0.001.

Suggestions

Educational Institutions

It is recommended that students expand their knowledge and conduct further research on the relationship between exclusive breastfeeding and pneumonia incidence among toddlers to enhance academic insight and evidence-based practice.

For the Research Site (Padasuka Public Health Center)

It is advised to strengthen health promotion programs through regular counseling sessions, educational leaflets, and mother–toddler classes. Additionally, efforts should be made to sustain the Early Initiation of Breastfeeding (IMD) program and provide continuous postpartum lactation support.

For Future Researchers

Future studies are encouraged to use research methods that control for confounding factors such as immunization status, nutritional condition, exposure to cigarette smoke, and environmental sanitation. It is also recommended to apply a longitudinal study design to assess the long-term effects of exclusive breastfeeding on child health outcomes.

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